

WHAT IS CLAIMED IS:

1. A system of remotely detecting and locating faults in a power system,  
said system comprising:
  - at least one slave controller disposed proximate at least one load and
  - 5 electrically connected to the at least one load via at least one conductor, wherein the at least one slave controller comprises:
    - at least one solid-state switch capable of controllably altering the input current to the at least one load; and
    - at least one measuring element for measuring at least one parameter
    - 10 associated with the at least one load and the at least one solid-state switch, wherein said solid-state switch controllably alters the input current to the at least one load according to the at least one parameter; and
    - at least one supplemental protection module electrically connected to the at least one conductor between the at least one slave controller and the at least one load,
    - 15 wherein the at least one supplemental protection module is capable of detecting at least one fault in at least one conductor.
2. A system according to Claim 1, wherein each supplemental protection module is capable of notifying a respective slave controller when the supplemental  
20 protection module detects a fault such that the at least one solid-state switch of the respective slave controller can alter the input current to the at least one load.
3. A system according to Claim 1, wherein the at least one solid-state switch operates in at least one mode selected from a group consisting of an on mode  
25 wherein the at least one solid-state switch permits a respective load to receive the input current, and an off mode wherein the at least one solid-state switch prevents the respective load from receiving the input current, and wherein when the at least one solid-state switch operates in the off mode the at least one supplemental protection module is capable of testing the at least one conductor before the at least one solid-  
30 state switch is placed in the on mode to thereby detect at least one fault.
4. A system according to Claim 1, wherein each supplemental protection module is capable of detecting at least one fault comprising at least one damaged conductor by:

transmitting at least one test pulse along at least one respective conductor and receiving at least one reflection from the at least one respective conductor; and comparing the at least one reflection to reference data to thereby at least one of detect and locate at least one damaged conductor.

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5. A system according to Claim 4, wherein each supplemental protection module is further capable of detecting at least one damaged conductor by converting the at least one reflection to digital data representative of the at least one reflection, and wherein each supplemental protection module is capable of comparing the at least one reflection to reference data by comparing the digital data to the reference data.

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6. A system according to Claim 5, wherein each supplemental protection module is capable of converting the at least one reflection to digital data with at least one resolution.

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7. A system according to Claim 4, wherein each supplemental protection module is further capable of determining at least one length of the at least one conductor based upon at least one transit time between transmission of the at least one test pulse and reception of the respective at least one reflection, and wherein each supplemental protection module is capable of comparing the at least one reflection to reference data by comparing the at least one determined length to at least one reference length.

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8. A system according to Claim 7, wherein each supplemental protection module is capable of comparing the at least one determined length to the at least one reference length and detecting at least one damaged conductor when the at least one determined length is shorter than the respective at least one reference length by more than a threshold length, and wherein each supplemental protection module is capable of locating the damage as a point on the respective at least one conductor at the at least one determined length.

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9. A system according to Claim 1, wherein each supplemental protection module is capable of detecting at least one fault comprising an electric arc event by

detecting at least one of white noise and chaotic behavior in current through the at least one conductor to the at least one load.

10. A system according to Claim 9, wherein each supplemental protection  
5 module is capable of detecting white noise by detecting a spectrally dense current through the at least one conductor to the at least one load.

11. A system according to Claim 9, wherein each supplemental protection  
10 module is capable of notifying a respective slave controller when the supplemental protection module detects an electric arc event such that the at least one solid-state switch of the respective slave controller can alter the input current to the at least one load to prevent the respective load from receiving the input current, and wherein when the respective slave controller alters the input current to prevent the respective load from receiving the input current the respective supplemental protection module can at  
15 least one of verify the electric arc event and locate the electric arc event on the respective conductor.

12. A system according to Claim 1, wherein each supplemental protection  
20 module is capable of detecting at least one fault comprising at least one abnormal current representative of at least one of a short circuit and an electric arc event.

13. A system according to Claim 12, wherein each conductor comprises a pair of conductors, and wherein each supplemental protection element is capable of detecting at least one fault by:

25 receiving a measurement representative of a current difference in the pair of conductors; and

comparing the measurement to a predefined threshold such that the supplemental protection element is capable of detecting an abnormal current representative of a short circuit when the measurement is greater than the predefined  
30 threshold.

14. A system according to Claim 12, wherein each supplemental protection module is capable of notifying a respective slave controller when the supplemental protection module detects at least one abnormal current representative of at least one

of a short circuit and an electric arc event such that the at least one solid-state switch of the respective slave controller can alter the input current to the at least one load to prevent the respective load from receiving the input current, and wherein when the respective slave controller alters the input current to prevent the respective load from receiving the input current the respective supplemental protection module can at least one of verify the at least one abnormal current representative of at least one of a short circuit and an electric arc event and locate at least one of the short circuit and the electric arc event on the respective conductor.

10            15.    A method of remotely detecting at least one fault in a power system comprising:

              configuring a processing element that controls input current through at least one switch to at least one load via at least one conductor, wherein the configuring is based upon at least one characteristic selected from a group consisting of a current rating of each load, a voltage rating of each load, a maximum current rating of each switch and a temperature rating of each switch;

              operating each switch in an off mode wherein each switch prevents the input current from flowing to a respective load;

              testing the at least one conductor to thereby detect at least one fault in the at least one conductor;

              operating each switch in an on mode wherein each switch permits the input current to flow to a respective load when no damaged conductors are detected, and thereafter controlling the input current to the at least one load, wherein controlling the input current comprises:

              monitoring at least one parameter associated with each switch and respective load selected from a group consisting of the input current to the load, a voltage drop across the load, the input current through the switch and a temperature of the switch;

              determining a condition of each switch and respective load depending upon at least one of the at least one characteristic and the at least one parameter;

              monitoring the at least one conductor to thereby detect at least one fault in the at least one conductor; and

operating each switch in at least one mode selected from a group consisting of the on mode and the off mode depending upon the condition of the respective loads and at least one fault in the at least one conductor.

5           16.     A method according to Claim 15, wherein testing the at least one conductor comprises:  
transmitting at least one test pulse down at least one respective conductor and receiving at least one reflection from the at least one respective conductor; and  
comparing the at least one reflection to reference data to thereby at least one of  
10 detect and locate at least one damaged conductor.

17.     A method according to Claim 16, wherein testing the at least one conductor further comprises converting the at least one reflection to digital data representative of the at least one reflection, and wherein comparing the at least one  
15 reflection to reference data comprises comparing the digital data to the reference data.

18.     A method according to Claim 17, wherein converting the at least one reflection comprises converting the at least one reflection to digital data with at least one resolution.

20           19.     A method according to Claim 16, wherein testing the at least one conductor further comprises determining at least one length of the at least one conductor based upon at least one transit time between transmission of the at least one test pulse and reception of the respective at least one reflection, wherein comparing  
25 the at least one reflection to reference data comprises comparing the at least one determined length to at least one reference length.

20.     A method according to Claim 19, wherein comparing the at least one determined length to the at least one reference length comprises detecting at least one  
30 damaged conductor when the at least one determined length is shorter than the respective at least one reference length by more than a threshold length, and wherein locating the at least one damaged conductor comprises locating a point on the respective at least one conductor at the at least one determined length.

21. A method according to Claim 15, wherein monitoring the at least one conductor to thereby detect at least one fault comprises monitoring the at least one conductor to thereby detect an electric arc event by detecting at least one of white noise and chaotic behavior in current through the at least one conductor to the at least one load.

22. A method according to Claim 21, wherein detecting white noise comprises detecting a spectrally dense current through the at least one conductor to the at least one load.

23. A method according to Claim 21, wherein operating each switch comprises operating at least one switch in the off mode when an electric arc event is detected on at least one conductor, and wherein the method further comprises testing the at least one conductor after operating the at least one switch in the off mode to thereby at least one of verify the electric arc event and locate the electric arc event on the respective at least one conductor.

24. A method according to Claim 15, wherein monitoring the at least one conductor to thereby detect at least one fault comprises monitoring the at least one conductor to thereby detect at least one abnormal current representative of at least one of a short circuit and an electric arc event.

25. A method according to Claim 24, wherein each conductor comprises a pair of conductors, and wherein monitoring each of the at least one conductor comprises:

receiving a measurement representative of a current difference in the pair of conductors; and

comparing the measurement to a predefined threshold, wherein an abnormal current is detected when the measurement is greater than the predefined threshold.

26. A method according to Claim 24, wherein operating each switch comprises operating at least one switch in the off mode when at least one abnormal current representative of at least one of a short circuit and an electric arc event is detected on at least one conductor, and wherein the method further comprises testing

the at least one conductor after operating the at least one switch in the off mode to thereby at least one of verify the at least one abnormal current representative of at least one of a short circuit and an electric arc event and locate at least one of the short circuit and the electric arc event on the respective at least one conductor.

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